

Translocation of *Alona muelleri* Richard, 1897 into the genus
Karualona Dumont & Silva-Briano, 2000
(Branchiopoda: Anomopoda: Chydoridae)

Перемещение вида *Alona muelleri* Richard, 1897
в род *Karualona* Dumont & Silva-Briano, 2000
(Branchiopoda: Anomopoda: Chydoridae)

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KEY WORDS: Cladocera, Anomopoda, Chydoridae, redescription, systematics.

КЛЮЧЕВЫЕ СЛОВА: Cladocera, Anomopoda, Chydoridae, переописание, систематика.

ABSTRACT. The South-American cladoceran *Alona muelleri* Richard, 1897, (original spelling *A. mulleri*) is redescribed and translocated to the genus *Karualona* Dumont & Silva-Briano, 2000. *K. muelleri* was presumed to be a synonym of *Karualona karua* (King, 1843), but differs from other species of *Karualona* by morphology of postabdomen and postabdominal claws, shape of exopodites III–IV, armament of IDL and ODL. The closest relative of *K. muelleri* is the Mexican *K. pennuelasi* Dumont & Silva-Briano, 2000. Relationships of *K. muelleri* within the genus, its ecology and distribution are discussed. An updated key to species of *Karualona* of the world is provided.

РЕЗЮМЕ. Южноамериканский вид ветвистоусых раков *Alona muelleri* Richard, 1897, (исходное написание видового названия *A. mulleri*) был переописан и перенесен в род *Karualona* Dumont & Silva-Briano, 2000. Ранее *K. muelleri* считался синонимом *Karualona karua* (King, 1843), однако он отличается от других видов рода *Karualona* строением постабдомена и его коготков, формой экзоподитов III–IV, вооружение внешней и внутренней дистальной доли первой ноги. Ближайшим к *K. muelleri* видом является мексиканский вид *K. pennuelasi* Dumont & Silva-Briano, 2000. Обсуждаются позиция вида *K. muelleri* внутри рода, его экология и распределение. Приводится определительный ключ для видов рода *Karualona* мировой фауны.

Introduction

Recent separation of the *karua*-group of the genus *Alona* Baird, 1843 into a separate genus *Karualona* Dumont &

Silva-Briano, 2000 was a first step of the urgently needed revision of the taxonomic structure of *Alona*, now the largest and most diverse genus of cladocerans. Five species of *Karualona* share several distinct characters, which clearly separate them from *Alona*. But the analysis of synonymy of *K. karua* (King, 1853), the type species, in this work is not complete, and one taxon, apparently belonging to *Karualona*, is not discussed. This taxon is *Alona muelleri* Richard, 1987, (original spelling *A. Müller*), described from Chile. For the original description of this taxon, see Richard [1897: 292–294], the somewhat shortened translation of his description is reproduced below:

“Length of an ovigerous female 0.36 mm, height 0.22 mm, body very compressed, subquadrangular. Dorsal margin of carapace weakly convex. Posterodorsal angle weakly defined. Posterior margin almost straight. Posteroventral angle rounded, with 4–5 relatively strong denticles. Ventral margin weakly convex, with row of setae ending before the first denticle of the posteroventral angle. Series of small setules located between last seta and first denticle, and in intervals between denticles, row of larger setules along the posterior margin on the inner side of carapace.

The head weakly flattened. Rostrum well-developed, not very acute, not reaching the level of the line which links the two ends of the ventral margin of valves. The surface of carapace with well-developed marked sculpture, in shape of parallel longitudinal lines without anastomoses in posterior half, in anteroventral part lines are spaced diagonally, almost crossing (similar to that in *A. Karua*, most close species). Eye weakly developed, with few ommatidia. Ocellus two times smaller than eye, between ocellus and eye slightly smaller than that between tip of rostrum end ocellus.

Antennule spindle-shaped, not reaching end of the rostrum, with 7–8 unequal sensory seta. Antenna small, the first segment of the dorsal branch with a strong spine; the third segments of both branches with 3 long articulated apical seta (without spine at the point of articulation) and an apical spine. The second segment of ventral branch presents with a seta. The distal edge of all segments with a more or less distinct crown of spinules. Labrum broad, with blunt tip.

Setae natatoriae very fine, a little longer than the distance between their base and preanal angle. Preanal angle of postabdomen weakly protruding. The anal part of dorsal margin with fine spinules. The distal part of the postabdomen is widened. Base of claws separated from distal margin by notch. Dorsal margin with 7–8 triangular teeth, very small, subequal in size. Above the dorsal margin, six very long slightly curved spines, at least four times longer than the corresponding tooth of the free edge. A comb of fine setae, much shorter and difficult to see, behind each of spines.

This species is especially close to *A. Karua* (King) Sars, which is not exceed 0.40 mm and has several characters of *A. Mulleri*, such as the sculpture of the valves and two small denticles on its posteroventral margin (much weaker than that of *A. Mulleri*). The postabdomen itself has a rather similar form in the two species, but in *A. Karua* the dorsal margin has a fine ciliation instead of small denticles, the side of postabdomen in *A. Karua* has 10 combs (instead of 6) and these combs do not similar to that of *A. Müllerii*."

The description was accompanied by three drawings, which are reproduced below (Figs 1–3). Sars [1901], dismissed *A. muelleri* as a synonym of *A. karua*. Like a number of species described at the end of 19th — beginning of 20th century, *A. muelleri* was treated as a synonym of another taxon (*A. karua*) by most recent authors [Smirnov, 1971, 2001; Alonso & Pretus, 1989]. Though the work of Dumont & Silva-Briano [2000] was appreciably grounded on the work of Alonso & Pretus [1989], the former authors did not even mention the name *A. muelleri* at all. They did not study any specimens of *Karualona* from South America.

The analysis of Richard's [1897] description shows that his taxon, having characteristic general shape, shape of postabdomen, and armament of postero-dorsal corner of valves, apparently belongs to *Karualona*. But it differs from all five species of *Karualona*, described by Dumont & Silva-Briano [2000] by the armament of postabdomen and postabdominal claw. It seems to be similar to *K. pennuelasi* Dumont & Silva-Briano, 2000, but differs from it by much more developed lateral fascicles of setules.

Specimens of *Karualona* with morphology that differs from all five species of the genus, but completely agrees with Richard's description, were found in Brazil. Examination of these specimens shows that *A. muelleri* is indeed a separate species, which should be translocated into *Karualona*. Examination of Sars' original South American material [Sars, 1901] shows that he also worked with *A. muelleri*.

Material and Methods

Studied material includes specimens taken by Dr G.-O. Brandorff in Brazil, Pantanal (Canal do Tamengo and Baia do Castelo) in 1998 (the material was preserved in 4% formalin) and several slides with specimens raised by G.O. Sars from dried mud from Brazil and Argentina, now in the collection of Zoological Museum of Oslo University. Animals were selected under a binocular stereoscopic microscope, placed on slides (in a drop of a glycerol-formaldehyde mixture) and studied under an optical microscope in total. Three adult females from Pantanal were dissected for analysis of appendages. For taking photos we used a Leitz-Dialux microscope with a system camera and interference optics.

ABBREVIATIONS. In illustrations and text: I–V — thoracic limbs I–V; as — accessory seta of limb I; cbs — copulatory brush seta of limb I; e1–3 — endites 1–3 of limb I; ep — epipodites of limbs; ex — exopodites of limbs; IDL — inner distal lobe of limb I; IP — interpore distance (distance between anterior and posterior major head pores); ms — male setae of limb I or antennule; ODL — outer distal lobe of limb I; PP — postpore distance (distance between posterior head pore and posterior corner of head shield); s — sensillum.

Results

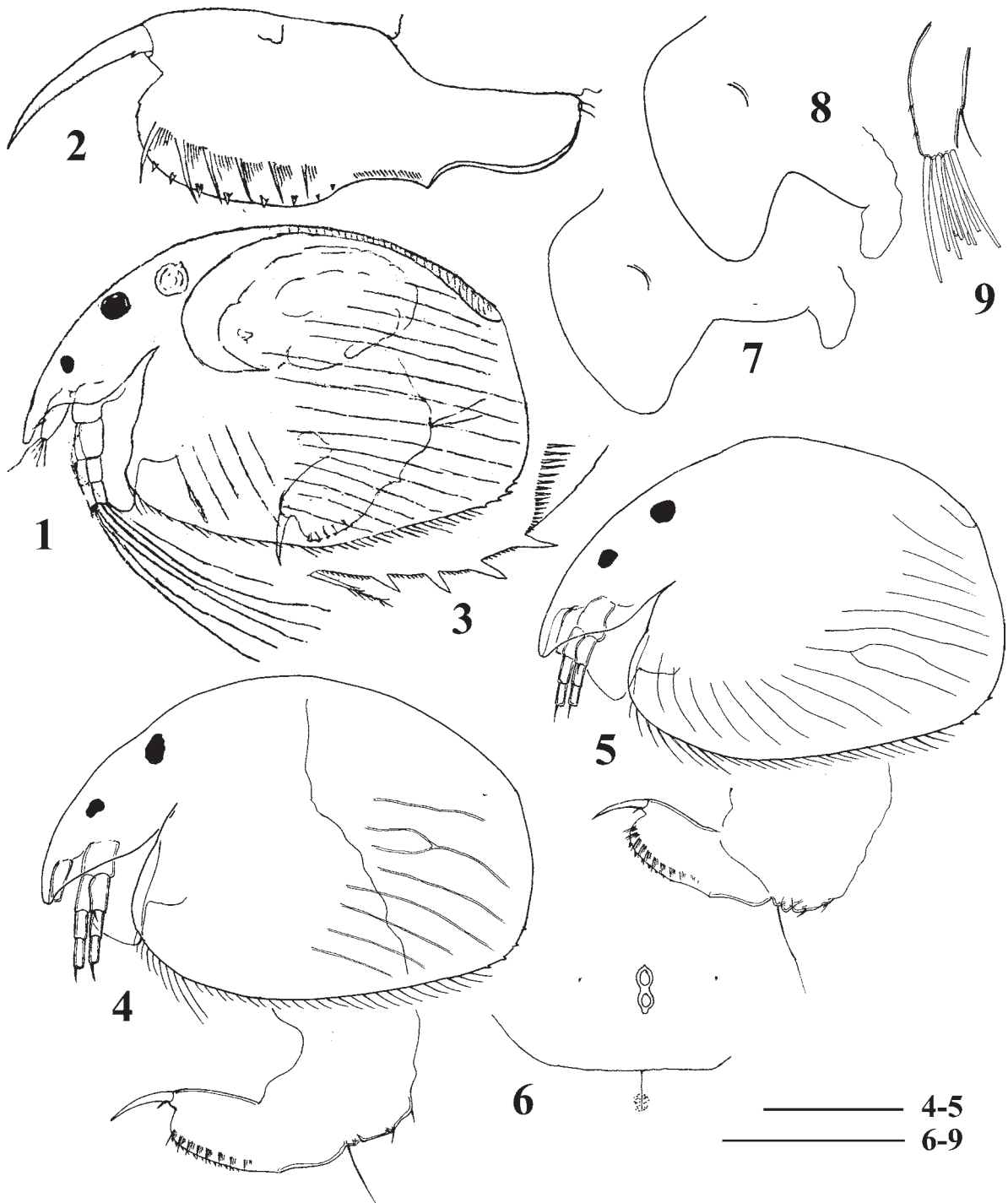
Karualona muelleri (Richard, 1897) Figs 1–33.

Richard, 1897 (292–294, Fig. 39–41: *Mulleri*); Sars, 1901 (59–60, pl. X., fig. 2, 2a–d) *Alonella karua*).

MATERIAL. 3 parthenogenetic ♀♀ from Brazil, Pantanal, Baia do Castelo, IV.1998, coll. G.-O. Brandorff; 2 parthenogenetic ♀♀ from Brazil, Pantanal, Canal do Tomengo, IV.1998, coll. G.-O. Brandorff; 22 parthenogenetic ♀♀ from Brazil, Itatiba, specimens hatched by G. O. Sars from dried mud, ZMOU, slides F9098, F9099.

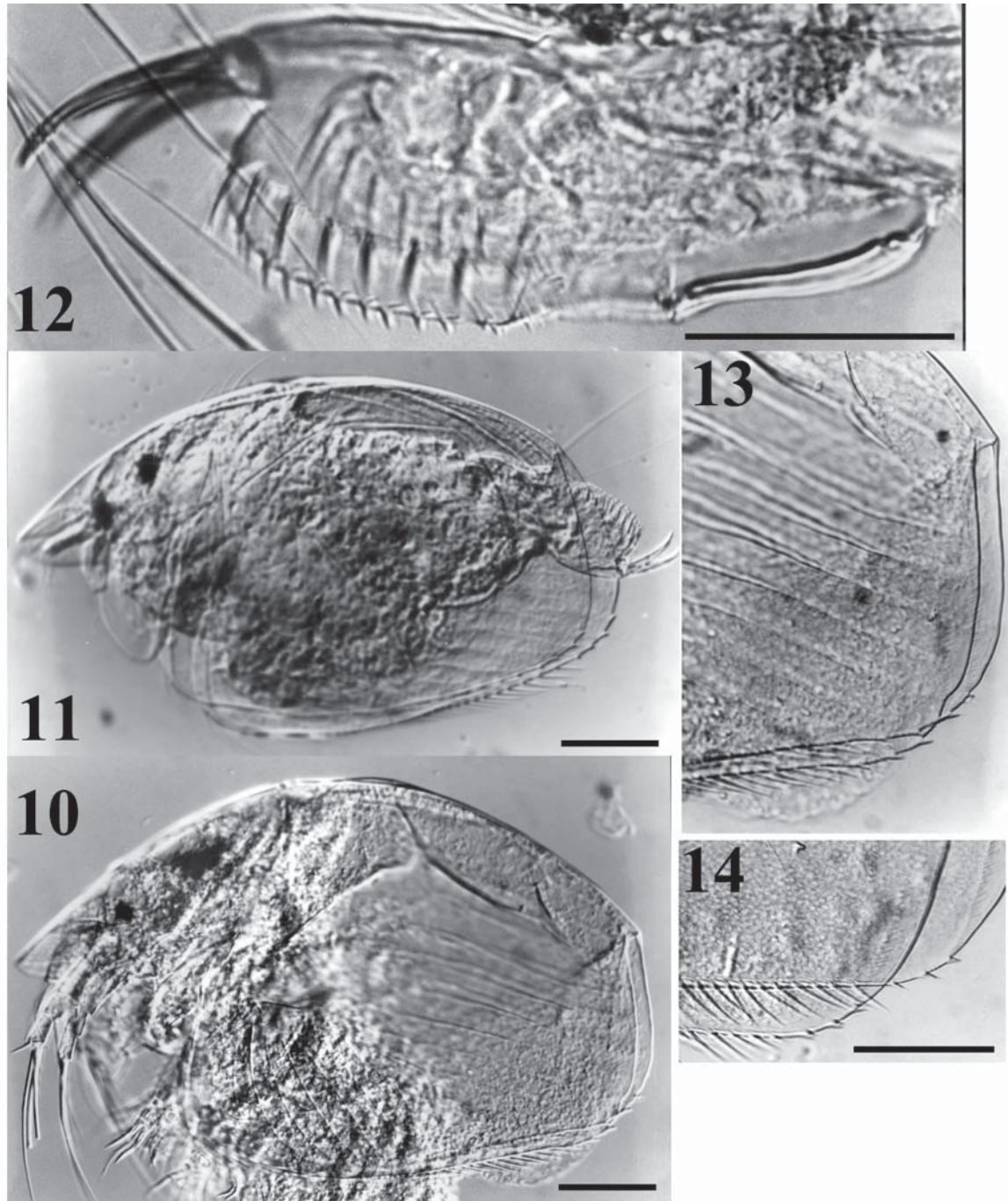
DIAGNOSIS. Female. Body as for genus, length about 1.4–1.5 times maximum height. Sculpture of valves as for genus. Setae at ventral margin significantly differentiated in size. Postero-ventral corner with 3–5 robust denticles, with 5–7 small setules between each pair of denticles. Head shield as for genus. Major head pores as for genus. PP = 1.1 IP. Lateral head pore located about 1–1.2 IP distance from midline, at level of anterior major head pore. Labrum as for genus.

Shape of postabdomen as usual for the genus, length 2.4–2.6 height. Distal margin almost straight, rounded angle between distal and dorsal margins. Dorsal margin concave, with distal part about 1.6–1.7 times longer than preanal, with postanal portion 2 times longer than anal. Both preanal and postanal angles weakly defined. Provided with seven to eight short, but robust marginal postanal denticles, either single, without any additional denticles or with only one much smaller denticle behind, and with 3 groups of marginal setules on anal margin. Nine to ten well-developed lateral fascicles of setules, posteriormost setae of each fascicle very thick and long, in distal fascicles three times longer than marginal denticles. Postabdominal claws



Figs 1-9. *Karualona muelleri* (Richard, 1897), parthenogenetic ♀♀ from Chile, neighborhood of Valparaiso (1-3), and from Brazil, Pantanal, Canal do Tamengo (4-9): 1-3 — lateral view, postabdomen and posteroventral corner of the valves (from Richard, 1897, no scale bar); 4, 5 — lateral view; 6 — head pores; 7, 8 — labrum; 9 — antennula. Scale: denote 0.1 mm (4, 5) and 0.05 mm (6-9).

Рис. 1-9. *Karualona muelleri* (Richard, 1897), партеногенетические ♀♀ из Чили, окрестности Вальпараисо (1-3), и из Бразилии, Пантаналь, Canal do Tamengo (4-9): 1-3 — внешний вид, постабдомен и задненижний угол створки (по Richard, 1897, без масштаба); 4, 5 — внешний вид; 6 — головные поры; 7, 8 — лярбрум; 9 — антеннула. Масштаб: 0,1 мм (4-5) и 0,05 мм (6-9).



Figs 10–14. *Karualona muelleri* (Richard, 1897), parthenogenetic ♀♀ from Brazil, Pantanal, Canal do Tamengo: 10, 11 — lateral view; 12 — postabdomen; 13, 14 — posteroventral corners of left and right valves of the same individual. Scale: denote 0.05 mm.

Рис. 10–14. *Karualona muelleri* (Richard, 1897), партеногенетические ♀♀ из Бразилии, Пантаналь, Canal do Tamengo: 10, 11 — внешний вид; 12 — постабдомен; 13, 14 — задненижние углы левой и правой створок одного экземпляра. Масштаб 0,05 мм.

as usual for the genus, Basal spine small, but distinct, pecten as usual for the genus.

Antennule as for genus. Antennal formula, setae 0-0-3/1-1-3, spines 1-0-1/0-0-1. Spine on basal segment of exopod shorter than middle segment. Spines on apical segments shorter than apical segments. Longest seta of apical

segment of endopod two times thicker than all other antennal setae.

ODL seta of trunk limb I with strong robust setules in distal part. Second and third IDL setae with strong robust setules in distal part. Scrapers 3 and 6 of limb II with more developed denticles than others. Exopodite III with seta 5

longer than seta 4. Exopodite IV with setae 4 and 5 subequal in length. Inner portions of limbs III–IV as for genus. Trunk limb V as for genus.

Male. Morphology as usual for the genus.

DIFFERENTIAL DIAGNOSIS. *K. muelleri* is closely allied to *K. pennuelasi*, but can be easily differentiated from it by more robust and long distal setules of the lateral fascicles of the postabdomen, proportions of setae on exopodites III–IV, morphology of scrapers on limb II, and number of denticles on the postero-ventral corner of valves. Differences between these two species are summarized in Table 1. *K. muelleri* is separated from all other species of the genus by robust, mostly single marginal postanal denticles of the postabdomen. It differs from *K. alsafadii* and *K. socotrana*, which have a basal spine of the postabdominal claw hardly larger than spinules of the adjacent pecten, by small, but distinct basal spine, similar to that of the other species of *Karualona*. It differs from *K. karua* and *K. iberica* by the strong setules on ODL and second and third IDL setae. The longest seta of apical segment of endopod of antenna being two times thicker than all other antennal setae is the unique character of *K. muelleri*.

DESCRIPTION. Parthenogenetic female. In lateral view irregular oval, maximum height before middle of body (Figs 4, 5, 10, 11) Length about 1.4–1.5 times maximum height. Dorsal margin curved, depression between head and rest of body absent. Postero-dorsal and postero-ventral angles broadly rounded. Posterior margin weakly convex. Postero-ventral corner with 3–5 robust denticles, with 5–7 small setules between each pair of denticles (Figs 13, 14, 17, 18). A row of about 60 setules along posterior margin at some distance from it on inner side of carapace. Ventral margin concave, with 40–45 setae, anterior 11–14 setae long, next 10–15 setae very short, after that length of setae increasing distally (Fig. 16). Antero-ventral angle rounded. Valves with prominent ridges in ventral and posterior part, with fine striae between them as usual for the genus.

Head relatively small, triangle-round in lateral view. In lateral view rostrum well developed, protruding downward. Eye larger than ocellus. Distance from tip of rostrum to ocellus slightly greater than that between ocellus and eye.

Shape of head shield as usual for the genus, with maximum width behind the mandibular articulation (Fig. 15). Rostrum short, broadly rounded. Posterior margin of head shield straight. Two large major head pores with a broad connection between them (Fig. 6). PP = 1.1 IP. Minute lateral head pores located about 1–1.25 IP distance from midline, at level of anterior major head pore.

Morphology of labrum as usual for the genus. Labral keel with a blunt apex (Figs 7, 8). Anterior margin of keel convex, posterior margin without any clusters of setules. The indentations on the lateral sides of labrum similar to those found in the other species of *Karualona* [see Dumont & Silva-Briano, 2000].

Thorax and abdomen subequal in length. First abdominal segment with two transverse rows of short setules.

Postabdomen of moderate width, length ca. 2.4–2.6 height (Figs 12, 21, 22). Ventral margin slightly convex. Inflated basis of claws bordered from distal margin by clear incision. Distal margin almost straight, rounded angle between distal and dorsal margins. Dorsal margin concave, with distal part about 1.6–1.7 times longer than preanal one, with postanal portion 2 times longer than anal one. Both preanal and postanal angles weakly defined. Preanal margin weakly convex.

Postabdomen provided with 7–8 short, but robust marginal postanal denticles, either single, without any addition-

al denticles or with only one much smaller denticle behind, and with three groups of marginal setules on anal margin. 9–13 well-developed lateral fascicles of setules, posteriormost setae of each fascicle very thick and long, in distal fascicles three times longer than marginal denticles.

Antennule elongated, slender, almost reaching the tip of rostrum (Fig. 9). Antennular sensory seta slender, two times shorter than antennule, arising at 2/3 distance from the base. Nine aesthetascs, longest of them equal in length to antennule, others little shorter. All aesthetascs projecting beyond anterior margin of the head shield.

Antenna of moderate length (Fig. 19). Antennal formula, setae 0-0-3/1-1-3, spines 1-0-1/0-0-1. Basal segment and branches relatively elongated, all segments cylindrical, basalmost segments of both endopod and exopod 1.5 times longer than others. Seta arising from basal segment of endopod thin, reaching tip of distal segment. Seta arising from middle segment of endopod of similar size with apical setae. Longest seta arising from apical segment of endopod two times thicker than all others antennal setae. Spine on basal segment of exopod shorter than middle segment. Spine from apical segment of exopod shorter than this segment. Apical spine of endopod shorter than this segment.

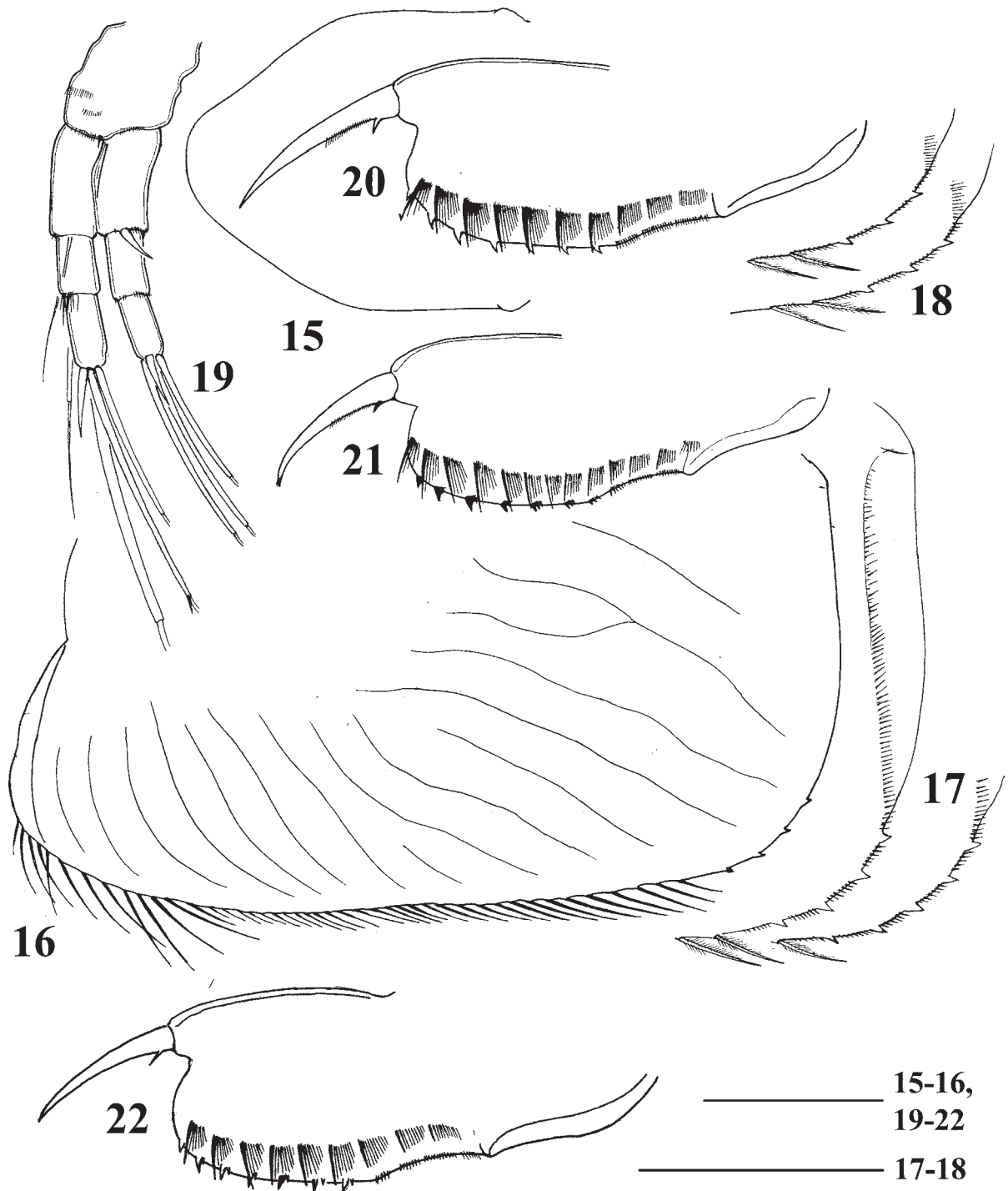
Trunk limbs: five pairs. Trunk limb I of moderate size (Fig. 23). Epipodite oval, without finger-like projection. Accessory seta short, thin, setulation on it not visible under optical microscope. ODL seta with strong thick setules in distal part, their length exceeds the width of seta at its base (Fig. 24). IDL with 2 clusters of small setules on ventral face (Fig. 25), 1st IDL seta three times shorter than others, 2nd and 3rd IDL setae relatively short and thick, subequal in length, both with strong, thick setules in distal part.

Endite 3 with four setae subequal in length. On endite 2 there are three densely feathered setae, middle of them equal in length to ODL seta. Endite 1 with two 2-segmented setae, both setulated in distal part, and a flat, geniculated, feathered in distal part seta shifted to the limb base. No naked setae on anterior face of limb visible under optical microscope. Five rows of long setules on ventral face of limb. Two ejector hooks, one of them 1.5 times longer than other.

Trunk limb II triangular-round (Fig. 26). Exopodite elongated, of irregular shape, with broad finger-like process (Fig. 27). Inner portion of limb (“endopodite”) with eight scraping spines increasing progressively in length distally. Scrapers 3 and 6 with more robust denticles than others. A portion of gnathobase bordering with “endopodite” setulated. Distal armature of gnathobase with four elements. Filter plate II with seven setae, the posteriormost member considerably shorter than others.

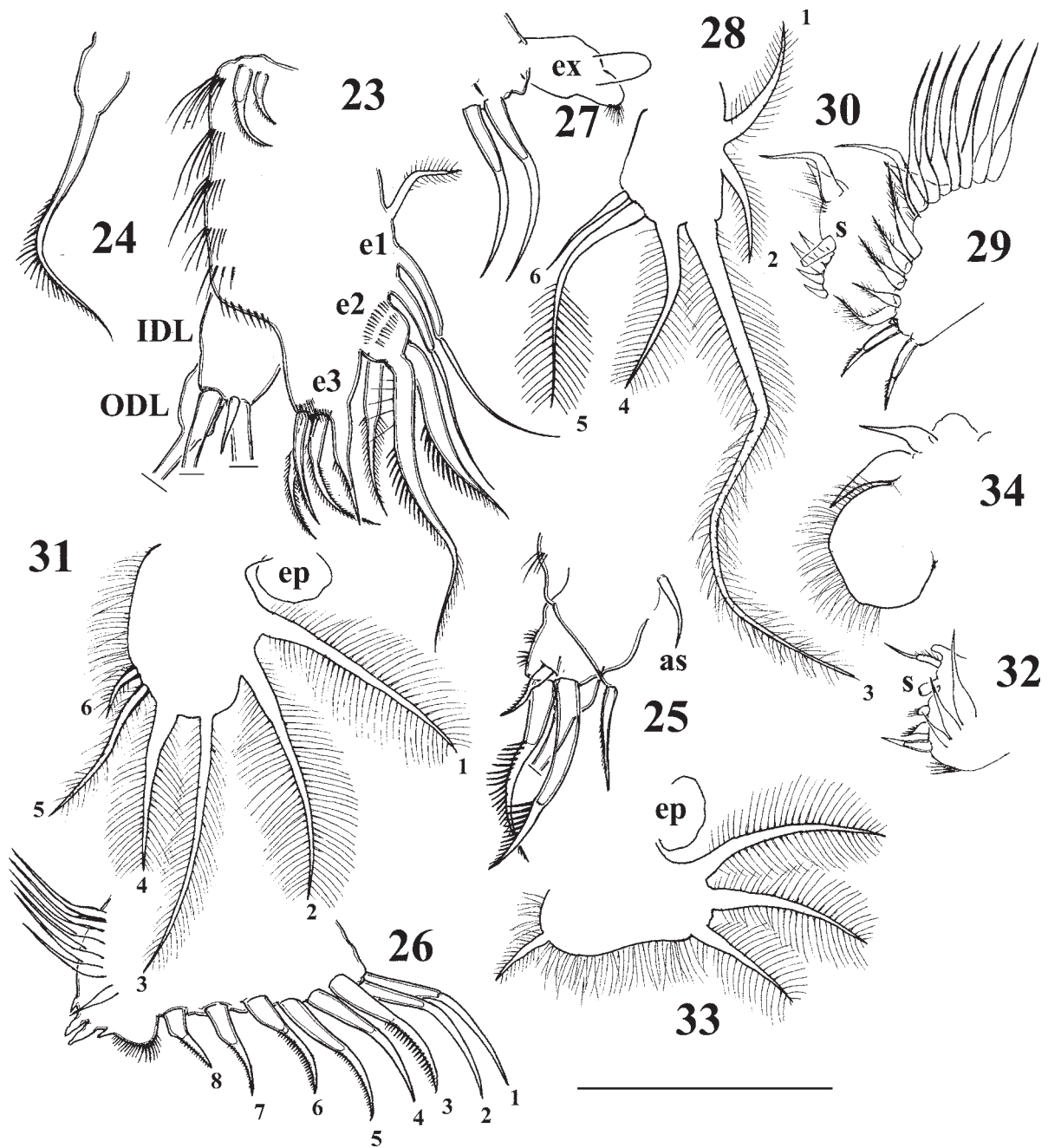
Trunk limb III. Epipodite oval, without any projection. Exopodite elongated, with six setae, subdivided into distal and basal groups (Fig. 28). Seta 3 longest, 3 times longer than seta 5, seta 4 little shorter than seta 5, all other setae 2 times shorter than seta 5. Seta 6 naked, seta 5 feathered by thick setules in distal part, others completely feathered by thin setules. Inner portion of the limb (Figs 29, 30) of same morphology as in the other species of *Karualona* [see Alonso & Pretus, 1989; Dumont & Silva-Briano, 2000].

Trunk limb IV. Pre-epipodite ovoid, setulated; epipodite globular, without any projection. Exopodite oval, with six setae (Fig. 31). Seta 3 being longest, but more slender and provided with much shorter setules than setae 1, 2 and 4. Setae 4 and 5 subequal in length, seta 6 very short. All setae feathered. Inner portion of the limb (Fig. 32) of same mor-



Figs 15–22. *Karualona muelleri* (Richard, 1897), parthenogenetic ♀♀ from Brazil, Pantanal, Canal do Tamengo (16–21) and Argentina, specimen raised from dried mud by G.O. Sars (22): 15 — outline of anterior part of head shield; 16–18 — valve and posteroventral corners of left and right valves of the same individual; 19 — antenna; 20–22 — postabdomen. Scale: denote 0.05 mm.

Рис. 15–22. *Karualona muelleri* (Richard, 1897), партеногенетические ♀♀ из Бразилии, Пантаналь, Pantanal, Canal do Tamengo (16–21) и Аргентины, экземпляр выращенный из высохшего ила Г.О. Сарсом (22): 15 — контуры переднего края головного щита; 16–18 — створка и задненижние углы левой и правой створок одного экземпляра; 19 — антенна; 20–22 — постабдомен. Масштаб 0,05 мм.



Figs 23–33. *Karualona muelleri* (Richard, 1897), parthenogenetic ♀ from Brazil, Pantanal, Canal do Tamengo: 23–25 — limb I, its ODL and IDL; 26, 27 — limb II and its exopodite; 28–30 — exopodite and parts of inner portion of limb III; 31, 32 — exopodite and inner portion of limb IV; 33–34 — exopodite and inner portion of limb V. Scale: denote 0.05 mm.

Рис. 23–33. *Karualona muelleri* (Richard, 1897), партеногенетическая ♀ из Бразилии, Пантаналь, Canal do Tamengo: 23–25 — нога I, ее внешняя и внутренняя дистальные доли; 26, 27 — нога II и ее экзоподит; 28–30 — экзоподит и внутренняя часть ноги III; 31, 32 — экзоподит и внутренняя часть ноги IV; 33, 34 — экзоподит и внутренняя часть ноги V. Масштаб 0,05 мм.

phology as in the other species of *Karualona* [see Alonso & Pretus, 1989; Dumont & Silva-Briano, 2000].

Trunk limb V. Epipodite ovoid, without any projection. Exopodite suboval, not subdivided into two lobes, lateral group with 3 long, densely setulated setae, distally only a single short seta (Fig. 33). Inner limb portion as rounded lobe, with setulated inner margin (Fig. 34). At

inner face, two short setae with very wide bases. No filter plate was found.

Trunk limb VI absent.

Ephippial female unknown.

Male (according to Sars' pictures [1901, PL. X, 2c–d]) of usual morphology for the genus. Body elongated, length about 2 times maximum height. Postabdomen with length

about 3 times height. Ventral margin straight, with clear step in region of gonopores, which open ventrally near basis of claws. Dorso-distal angle broadly rounded. Dorsal margin convex in postanal part, concave in anal part, preanal angle absent and postanal angle prominent. Clusters of setules in place of female marginal denticles, lateral fascicles of setules same as in female. Postabdominal claws shorter than in female, with very short basal spine.

SIZE. Length of female 0.3–0.36 mm.

VARIABILITY. Specimens from Pantanal and Itatiba differs by the length of basal spine of postabdominal claws and by the shape of marginal denticles. Pantanal specimens have shorter and stouter basal spine (Figs 20, 21), while in specimens from Itatiba it is somewhat more slender and longer (Fig. 22). Also, marginal denticles in Pantanal specimens are more robust, and in some specimens they are all single, while in Itatiba specimens they are more slender (still being much stronger than that of *K. karua*) and all are provided with an additional denticle behind.

ECOLOGY. The conditions in Castelo lake and surrounding drainage canals system were studied by Oliveira & Calheiros [2000]. Castelo Lake, located on the right margin of the Paraguay River belongs to a series of river-connected large lakes surrounded by higher land. Such lakes receive floodplain water from numerous drainage channels, one of which is Canal do Tamengo, and/or through the river mouth, when river level is higher than that of the lake. During the high water phase, aquatic plants colonize the floodplain, dying during the dry phase. A part of the dried material is carried to the lake by the subsequent flood. According to Oliveira & Calheiros [2000], water in area is warm, above 25°C, the pH is 6.4–7.1 in Castelo Lake and 6.3–6.8 in the surrounding canals. The cladoceran fauna of these water bodies includes members of several families (Sididae, Moinidae, Bosminidae, Chydoridae, Ilyocryptidae, and Macrothricidae), for exact composition of species see Holwedell et al. [2004].

DISTRIBUTION. *K. muelleri* now is known from Chile and Brazil but possibly inhabits a wider area, which may include all South America. Many authors have reported *K. karua* from different parts of South and Central America, but usually no drawing or description were provided, or sometimes [Olivier, 1962], they were of such general nature that they could suit almost any *Karualona*. But in a few cases when brief descriptions and drawings were provided, the morphology of the postabdomen of the reported specimens was similar to that of *K. muelleri*, not to *K. karua* s.str. Such reports come from Venezuela [Infante, 1980; Zoppi de Roa et al., 1985] and Nicaragua [Smirnov, 1988]. However in these reports appendages have not been studied, so it is impossible to be fully certain of the identity of the specimens.

Discussion

Comparison of *K. muelleri* with other species of the genus, based on recent work [Alonso & Pretus, 1989; Dumont & Brancelj, 1994; Dumont & Silva-Briano, 2000], reveals a number of distinctive characters, which clearly separate this species from all others.

The denticles on the postero-ventral corner of the valves are extremely robust in *K. muelleri*, similar to those of *K. pennuelasi*, whereas in all other species they are not so well-developed. But the latter species

possess only 1–4 setules between them, and in *K. muelleri* this number is 5–8.

The armament of postabdomen and postabdominal claws is the most apparent distinctive character of *K. muelleri*. The shape and composition of postanal denticles, which are robust and frequently single, are similar to that of *K. pennuelasi*, while other species have much smaller denticles in groups of 2–4. The lateral fascicles of setae in *K. muelleri* are well-developed, similar to that of *K. karua* and *K. socotrana*, while in other species, including *K. pennuelasi*, fascicles are shorter. The distinct basal spine of the postabdominal claws clearly separates *K. muelleri* from *K. alsafadii* and *K. socotrana*, with basal spine hardly larger than spinules of adjacent pecten.

The exopod of antennae with the longest seta of apical segment two times thicker than all other setae seems to be the unique character of *K. muelleri*. In all other *Karualona* all setae of this segment are of equal thickness. But morphology of antennal setae in *Karualona* has never been investigated in detail, so we are not sure whether it is a character of the species-level or just a variability of one species.

The armament of ODL seta of *K. muelleri* is similar to that of *K. pennuelasi*, its setules are strong, thick, their length exceeds the width of seta at its base. In contrast, such setules are weakly developed in *K. karua* and *K. iberica*. Setules of second and third IDL setae of *K. muelleri* are also stronger than in previous species.

Scrapers 3 and 6 of limb II in *K. muelleri* are provided with distinctly stronger denticles than scrapers surrounding them, similar to those of *K. karua* from eastern Australia (as reported by Alonso & Pretus, 1989). In all other species, and in *K. karua* from western Australia (see Dumont & Silva-Briano, 2000) there is no such differentiation.

The exopodite IV of *K. muelleri* is similar to that of *K. karua* and *K. iberica*., in all these species seta 3 is clearly the longest and the most slender, and seta 4 is the thickest, and subequal in length to seta 5. In *K. pennuelasi*, seta 4 is extremely short, two times shorter than seta 5, and in *K. alsafadii* and *K. socotrana* all exopodite IV setae, except the very short seta 6, are subequal in length and of equal thickness.

With the exception of the unique armament of antenna, morphology of *K. muelleri* seems to be a combination of features present in the other species of *Karualona*. However, in many features it is most similar to the Mexican *K. pennuelasi*, and this, together with the fact that they are the only species present in New World, suggests the close relationship between these two species. The relations between *K. muelleri* and the *Karualona* of Old World seem to be more distant.

This work is the first step of revision of South American *Karualona*. At present, we cannot be sure that all reports of *Karualona* species from this region refer to *K. muelleri*, and future investigations of this genus in South and Central America are needed. At present, the genus includes six species globally. A key to them is provided below.

Table 1. Differences between *Karualona muelleri* (Richard, 1987) and *K. pennuelasi* Dumont & Silva-Briano, 2000. Таблица 1. Различия между видами *Karualona muelleri* (Richard, 1987) и *K. pennuelasi* Dumont & Silva-Briano, 2000.

Characters	<i>K. muelleri</i>	<i>K. pennuelasi</i>
Lateral fascicles of setules on postabdomen	distal setule long, thick, 3 times longer than marginal denticles	distal setule thin, short, only 2 times longer than marginal denticles,
Postero-ventral corner of valves	with 5-7 setules between each pair of denticles	with 1-3 setules between each pair of denticles
Apical segment of endopod	with longest seta two times thicker than all others antennal setae	with all setae of same thickness
Scrapers of limb II	scrapers 3 and 6 with more robust denticles than others	all scrapers with equally thin denticles
Exopodite III	seta 5 longer than seta 4	setae 4 and 5 of equal length
Exopodite IV	seta 4 long, thin	seta 4 short and broad, 2 times shorter than seta 5

KEY TO THE KNOWN SPECIES OF *KARUALONA* (PARTHENOGENETIC FEMALES)

1. Postabdominal claws with basal spine hardly larger than spinules of adjacent pecten 2
— Postabdominal claws with basal spine small, but distinctly larger than spinules of adjacent pecten 3
2. Eye absent *alsafadii* (Dumont & Brancelj, 1994)
— Eye present . *K. socotrana* Dumont & Silva-Briano, 2000
3. Postanal marginal denticles of postabdomen thin, in groups of 2–4. Setules on ODL seta thin, hair-like, their length considerably smaller than the width of seta at its base ..
..... 4
— Postanal marginal denticles of postabdomen robust, single or with additional smaller denticle behind. Setules on ODL seta strong, thick, their length exceeds the width of seta at its base 5
4. PP =3 IP. Closest to exopodite scraper of limb II longer than following one. Length of adult ♀ 0.35–0.48 mm ...
..... *K. karua* (King, 1853)
— PP =2 IP. Two closest to exopodite scrapers of limb II of equal length. Length of adult ♀ 0.28–0.39 mm
..... *K. iberica* (Alonso & Pretus, 1989)
5. Lateral fascicles of setules with distal setae long, thick, 3 times longer than marginal denticles. Exopodite III with 2nd from endite seta longer than 3rd. Exopodite IV with 4th from endite setae 1.5 times longer than 3rd
..... *K. muelleri* (Richard, 1897)
— Lateral fascicles of postabdomen setules with distal setule thin, short, only 2 times longer than marginal denticles. Exopodite III with 2nd and 3rd from endite setae of equal length. Exopodite IV with 4th from endite setae more than 2 times longer than 3rd
..... *K. pennuelasi* Dumont & Silva-Briano, 2000

ACKNOWLEDGEMENTS. We are very grateful to Dr G.-O. Brandorff, who has provided us with the material, and Prof. N.N. Smirnov for his help in different phases of the work. We thank Dr L. Bachmann, Prof. M.E. Christiansen, and Senior Engineer A. Wilhelmsen for their kind assistance during AYS' work with Sars' collection and papers in Zoological Museum of Oslo. The study was supported by a grant

from the Russian Foundation for Basic Research (01-04-48404) and a grant from the Norway Council of Research (EJ/hsm IS OE01-112) for AYS.

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